BLM2425M9S20

LDMOS 2-stage power MMIC

AMPLEON

Rev. 2 — 17 May 2021

Product data sheet

1. Product profile

1.1 General description

20 W, 2-stage power MMIC transistor for use in a variety of Industrial, Scientific, Medical (ISM) and cooking applications at frequencies from 2400 MHz to 2500 MHz.

The BLM2425M9S20 is designed for high power CW applications and is assembled in a high performance plastic package.

Table 1. Application performance measured in class AB demo circuit

Test signal	f	V_{DS}	P_L	G_p	PAE
	(MHz)	(V)	(W)	(dB)	(%)
CW	2450	32	20	28	49

1.2 Features and benefits

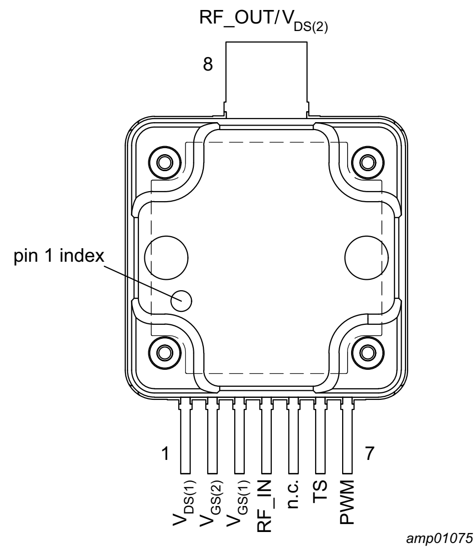
- High efficiency
- High power gain
- Excellent ruggedness
- Excellent thermal stability
- Integrated thermal sensor
- Integrated PWM control circuitry
- Integrated ESD protection
- Biasing of individual stages is externally accessible
- 50 Ω input matched; output pre-matched
- Designed for broadband operation (frequency 2400 MHz to 2500 MHz)
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- Professional and consumer cooking applications
- Industrial, Scientific and Medical applications
- Applicable at frequencies from 2400 MHz to 2500 MHz

2. Pinning information

2.1 Pinning



Transparent top view

The exposed backside of the package is the ground terminal of the device.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$V_{DS(1)}$	1	drain-source voltage of stage 1
$V_{GS(2)}$	2	gate-source voltage of stage 2
$V_{GS(1)}$	3	gate-source voltage of stage 1
RF_IN	4	RF input
n.c.	5	not connected
TS	6	temperature sense FET
PWM [1]	7	PWM modulation / RF on/off
RF_OUT/$V_{DS(2)}$	8	RF output / drain-source voltage of stage 2

[1] When PWM function is not used, it is advised to connect the pin to ground and not leave it unconnected to avoid unpredictable behavior due to unintended electrical charge on the pin.

3. Ordering information

Table 3. Ordering information

Package name	Orderable part number	12NC	Packing description	Min. orderable quantity (pieces)
OMP-400-8F-1	BLM2425M9S20Z	9349 603 26517	Tray; 30-fold; dry pack	90

4. Block diagram

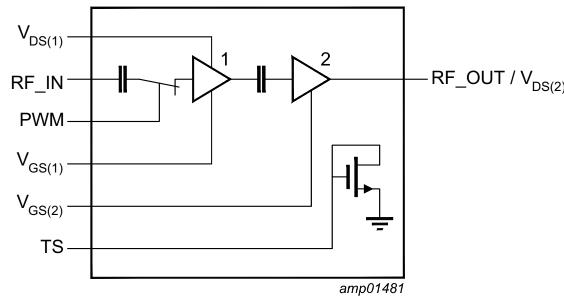


Fig 2. Block diagram of BLM2425M9S20

5. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage		-	65	V
V_{GS}	gate-source voltage		–6	+13	V
$V_{GS(sense)}$	sense gate-source voltage		–6	+9	V
V_{PWM}	pulse width modulation voltage		–6	+9	V
V_{TS}	temperature sensor voltage		–6	+5.5	V
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature	[1]	-	225	°C
T_{case}	case temperature		-	150	°C

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

6. Thermal characteristics

Table 5. Thermal characteristics

Measured for total device.

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	final stage; T_{case} = 90 °C; P_L = 20 W [1]	1.03	K/W

[1] When operated with a CW signal.

7. Characteristics

Table 6. DC characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Final stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.181 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 18.1 mA	1.5	1.9	2.5	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 32 V; I_D = 20 mA	1.4	1.8	2.4	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 32 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	3.65	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 633 mA	-	1.33	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 0.63 A	-	630	-	mΩ
Driver stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.037 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 3.7 mA	1.5	1.9	2.5	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 32 V; I_D = 10 mA	1.4	1.9	2.4	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 32 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	0.74	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 130 mA	-	0.264	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 0.4 A	-	2350	-	mΩ

Table 7. RF Characteristics

Test signal: CW pulsed; t_p = 100 μs; δ = 10 %; at f = 2450 MHz; RF performance at V_{DS} = 32 V; I_{Dq1} = 10 mA; I_{Dq2} = 20 mA; T_{case} = 25 °C; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 20 W	25.5	28	-	dB
PAE	power-added efficiency	P_L = 20 W	42	45	-	%
RL_{in}	input return loss	P_L = 20 W	-	−13	-	dB

8. Test information

8.1 Ruggedness

The BLM2425M9S20 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: V_{DS} = 36 V; P_L = 25 W; f = 2450 MHz; CW signal.

8.2 Impedance information

Table 8. Typical impedance

Simulated impedance data of input and output PCB. Typical values unless otherwise specified.

f	Z_S [1]	Z_L [1]
(MHz)	(Ω)	(Ω)
2400	52.87 + j10.43	17.09 – j1.74
2450	53.07 + j11.05	16.98 – j1.36
2500	53.32 + j11.63	16.89 – j0.98

[1] Z_S and Z_L defined in Figure 3

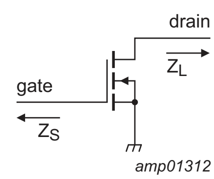
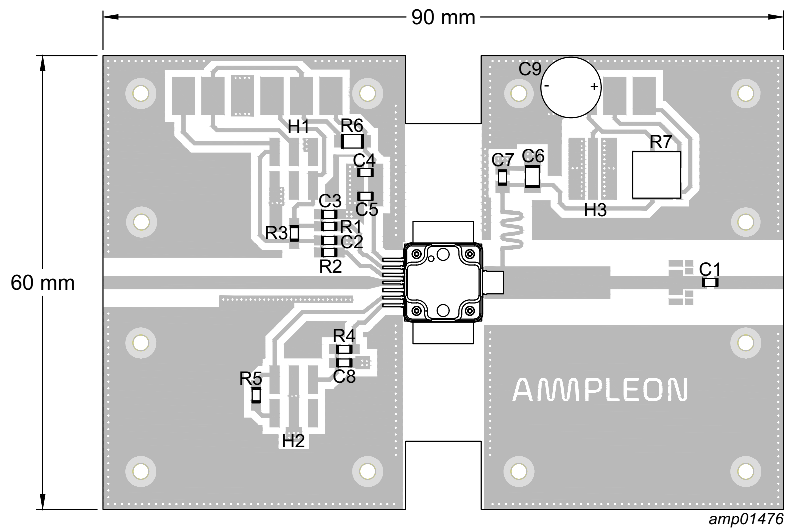


Fig 3. Definition of transistor impedance

8.3 Demo circuit



Printed-Circuit Board (PCB): Rogers TC350; ε_r = 3.48; height = 0.762 mm; thickness copper plating = 35 μm.

Remark: not used for production testing.

See Table 9 for a list of components.

Fig 4. PCB layout of class AB demo circuit

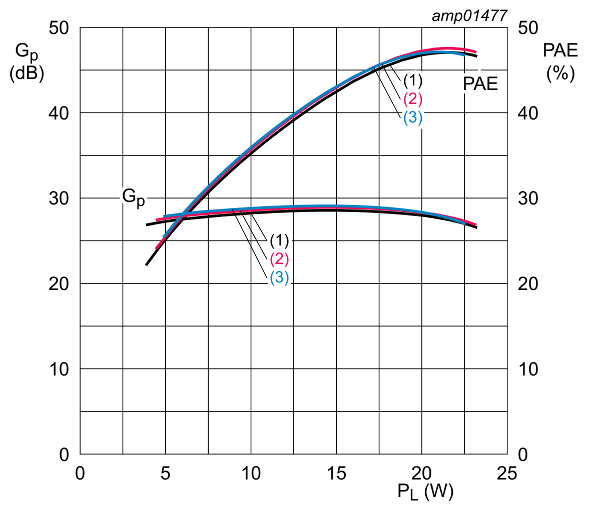
Table 9. List of components

See Figure 4 for component layout.

Component	Description	Value	Remarks
C1, C5, C7	multilayer ceramic chip capacitor	20 pF	ATC 800A
C2, C3, C4, C8	multilayer ceramic chip capacitor	1 μF, 100 V	SMD 0805
C6	multilayer ceramic chip capacitor	4.7 μF, 50 V	SMD 1206
C9	electrolytic capacitor	100 μF, 35 V	Elco
R1, R2	chip resistor	100 Ω	SMD 0805
R3	chip resistor	100 Ω	optional
R4	chip resistor	100 Ω	SMD 0805
R5	chip resistor	30 Ω	SMD 0805
R6	current sense resistor	0.1 Ω, 1 %	CRM1206-FX-R100ELF
R7	current sense resistor	0.01 Ω, 1 %	FC4L64R010FER
H1, H2, H3	6 pin headers		optional

Remark: When PWM function is not used, it is advised to connect the pin to ground and not leave it unconnected to avoid unpredictable behavior due to unintended electrical charge on the pin.

8.4 Graphical data



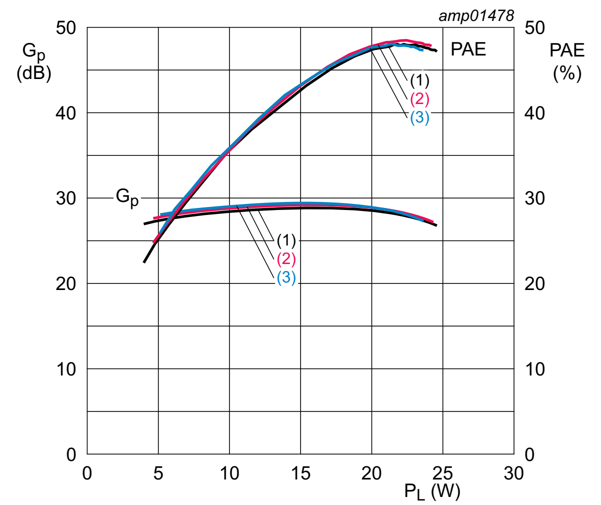
V_{DS} = 32 V; I_{Dq1} = 10 mA; I_{Dq2} = 20 mA; CW test signal.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

Fig 5. Power gain and power-added efficiency as function of output power; typical values



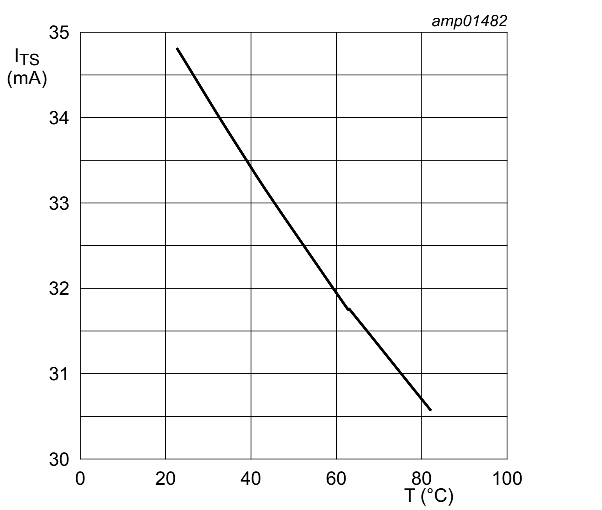
V_{DS} = 32 V; I_{Dq1} = 10 mA; I_{Dq2} = 20 mA; CW pulsed test signal: t_p = 100 μs; δ = 10 % .

(1) f = 2400 MHz

(2) f = 2450 MHz

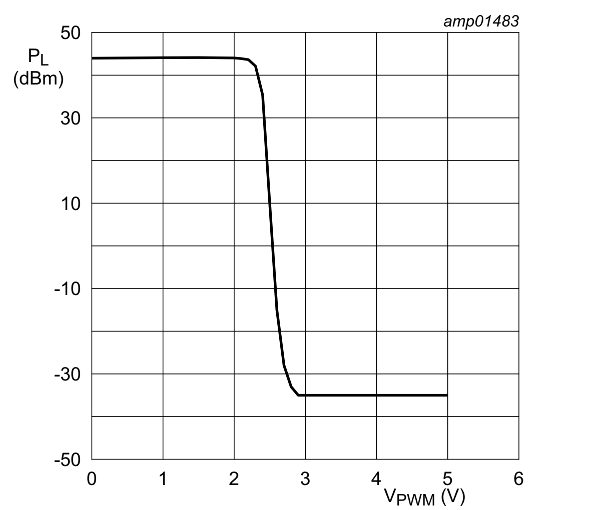
(3) f = 2500 MHz

Fig 6. Power gain and power-added efficiency as function of output power; typical values



V_{TS} = 5 V.

Fig 7. Temperature sensor current as a function of temperature; typical values

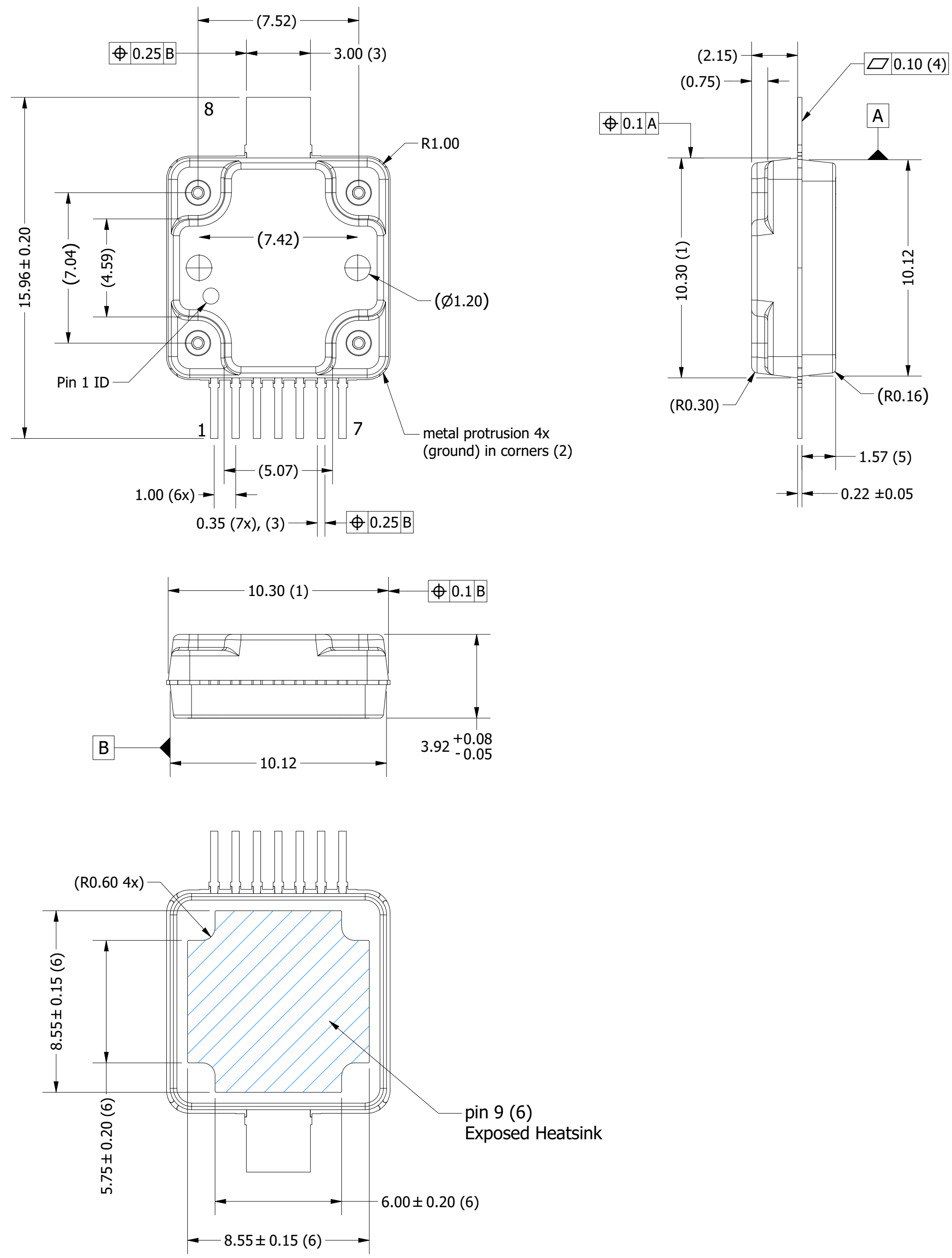


V_{DS} = 32 V; P_i = 15 dBm; f = 2450 MHz; I_{Dq1} = 10 mA; I_{Dq2} = 20 mA; T_{water} = 25 °C (at water-cooled heatsink).

Fig 8. Output power as a function of pulse width modulation voltage; typical values

9. Package outline

OMP-400-8F-1

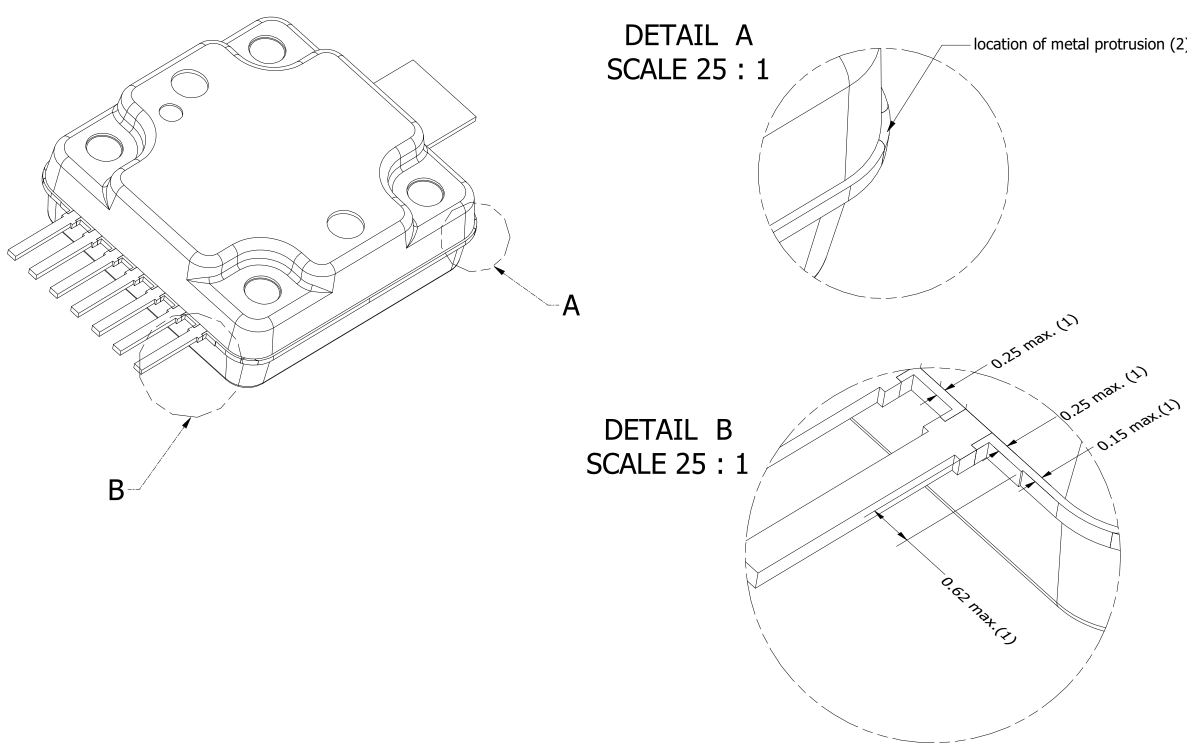


Package outline drawing: OMP-400-8F-1	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1° Third angle projection	Revision: 1 Revision date: 11/26/2019 Sheet 1 of 2

Fig 9. Package outline OMP-400-8F-1 (sheet 1 of 2)

OMP-400-8F-1

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. Areas located adjacent to the leads have a maximum mold protrusion of 0.25 mm (per side) and 0.62 mm max. in length. In between the 7 leads the protrusion is 0.25 mm. max. At all other areas the mold protrusion is maximum 0.15 mm per side. See also detail B.
(2)	The metal protrusion (tie bars) in the corner will not stick out of the molding compound protrusions (detail A).
(3)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(4)	The lead coplanarity over all leads is 0.1 mm maximum.
(5)	Dimension is measured 0.5 mm from the edge of the top package body.
(6)	The hatched area indicates the exposed heatsink. The dimensions represent the values between two opposite points along the original heatsink perimeter.
(7)	The leads and exposed heatsink are plated with matte Tin (Sn).



Package outline drawing: OMP-400-8F-1	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 11/26/2019
		Third angle projection	Sheet 2 of 2

Fig 10. Package outline OMP-400-8F-1 (sheet 2 of 2)

10. Handling information

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

Table 10. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1A [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 1A is granted to any part that passes after exposure to an ESD pulse of 250 V.

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
FET	Field-Effect Transistor
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MMIC	Monolithic Microwave Integrated Circuit
MTF	Median Time to Failure
PWM	Pulse Width Modulation
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
VSWR	Voltage Standing Wave Ratio

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM2425M9S20 v.2	20210521	Product data sheet	-	BLM2425M9S20 v.1
Modifications:	• Table 2 on page 2: added table note • Table 4 on page 3: changed temperature sensor voltage to 5.5 V • Section 8.3 on page 6: added remark about PWM			
BLM2425M9S20 v.1	20200924	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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